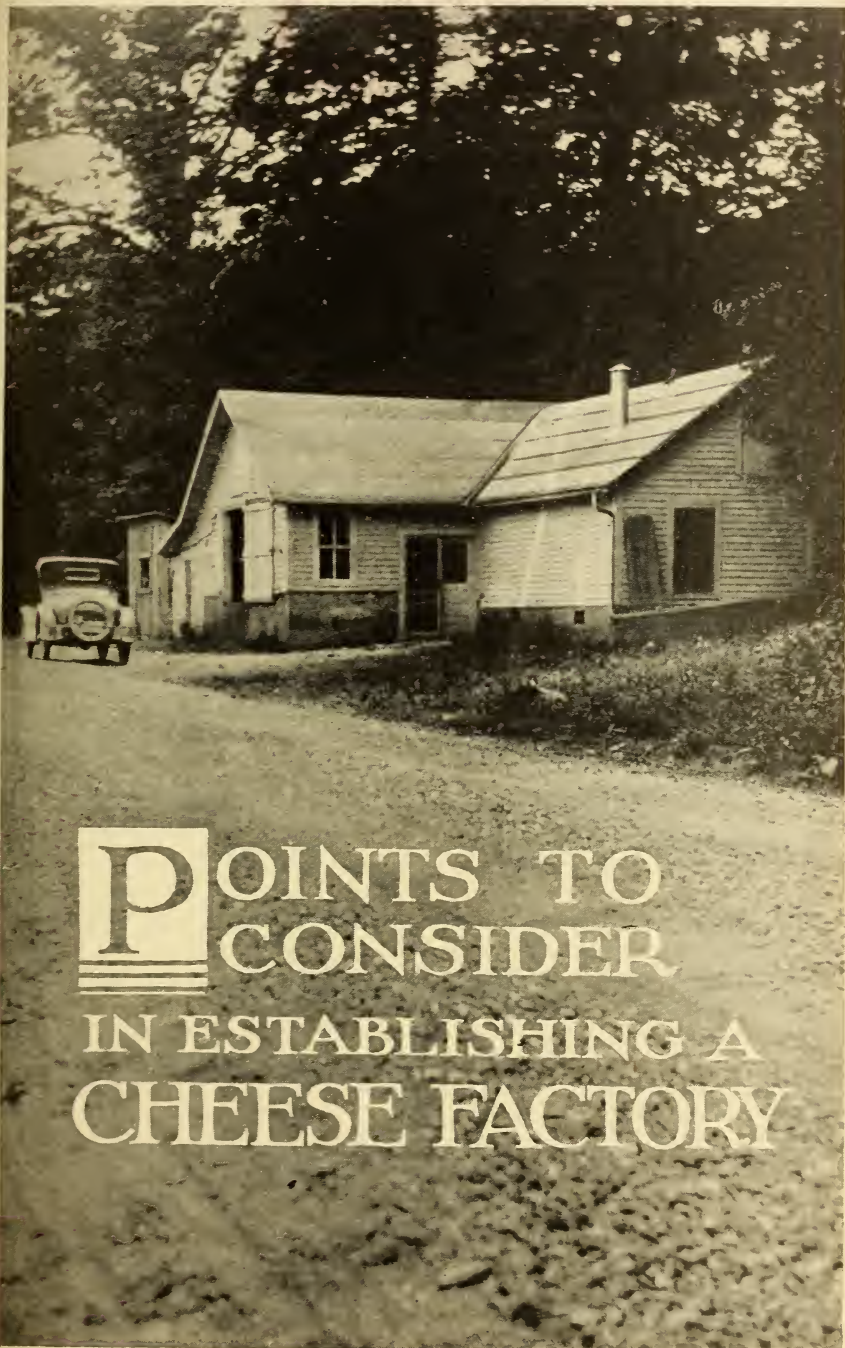


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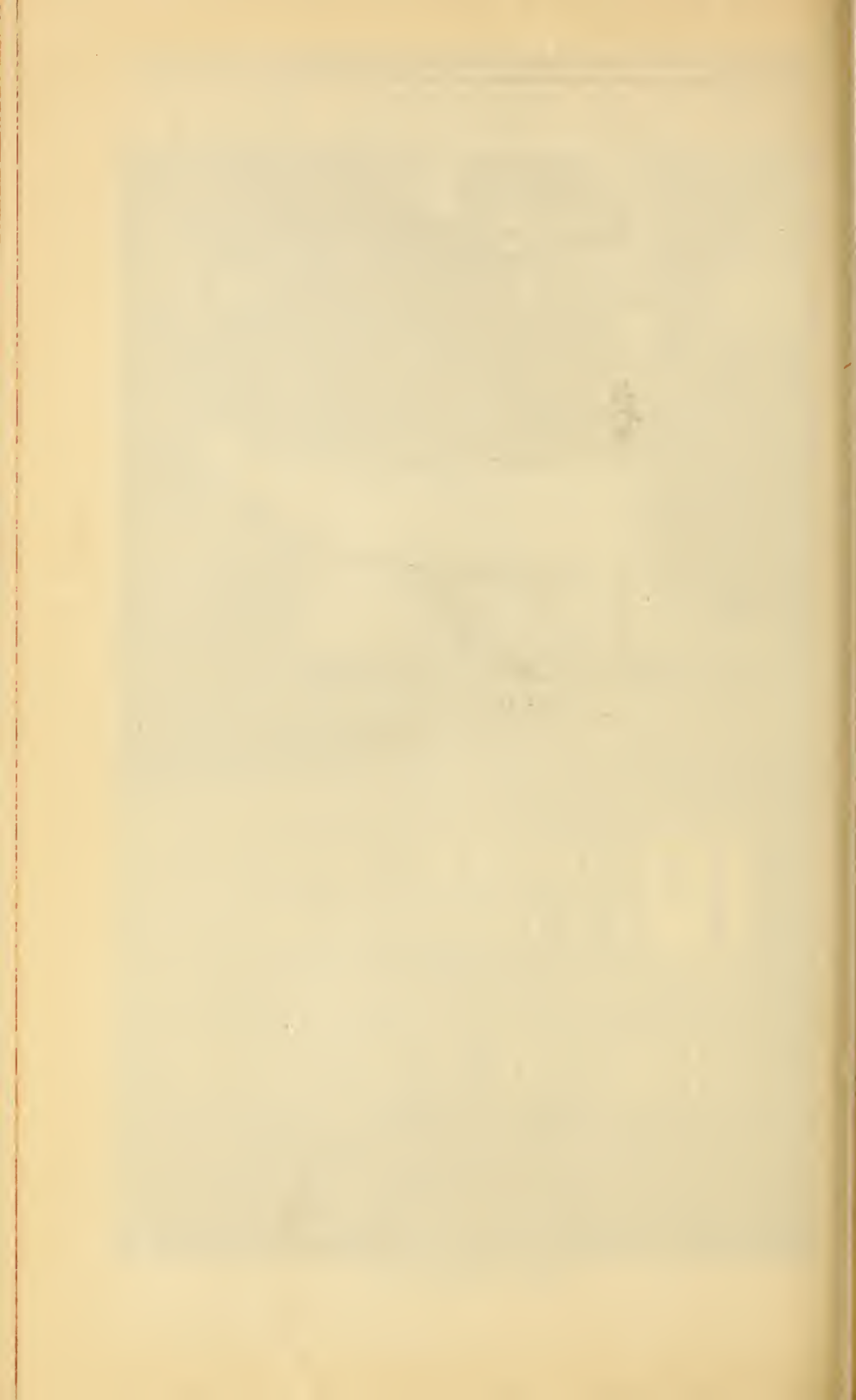


UNITED STATES DEPARTMENT OF AGRICULTURE  
MISCELLANEOUS PUBLICATION NUMBER 42



**P**OINTS TO  
CONSIDER  
IN ESTABLISHING A  
CHEESE FACTORY

ISSUED DECEMBER, 1928



# POINTS TO CONSIDER IN ESTABLISHING A CHEESE FACTORY

By H. L. WILSON, *Associate Dairy Manufacturing Specialist, Bureau of Dairy Industry*

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During the past year considerable interest has developed relative to the manufacture of cheese in new dairy sections of the country. Many inquiries have been received by this bureau regarding the conditions under which cheese can be made, total investment required, necessary equipment, and the approximate price which a cheese factory can pay for milk. It is to answer these and relative questions that this publication is prepared.

## CONDITIONS THAT FAVOR CHEESE MAKING

Cheese may be made during any season of the year. In sections where farmers prefer to sell whole milk, the operation of a cheese factory will furnish a market. The cost of a building and equipment is considerably less than for a creamery, condensery, or other dairy-manufacturing plant. The net returns to the farmer, however, are approximately the same over a period of three to five years from selling cream to be manufactured into butter or whole milk to be manufactured into cheese. A cheese factory can operate profitably in a community where there is not sufficient milk to operate a creamery or a condensery.

A cheese factory may be located in an isolated section because the volume of cheese is only approximately one-tenth the volume of milk from which it is made, and because the cheese when shipped is not so subject to spoilage as milk or other dairy products. Therefore the distance from market is less important in the case of cheese than with many other dairy products.

Cheese factories should not be expected to compete with market-milk plants. When milk is manufactured into cheese the by-products are fed to animals or wasted, and the returns are not so great as when whole milk is sold for human consumption.

## VOLUME OF MILK

The chief cause of cheese-factory failures is an inadequate supply of milk. This may be due to an insufficient number of cows within a reasonable hauling distance, or being located in a section where the

prevailing prices paid by near-by plants are higher than a cheese factory can pay. When starting a cheese factory, therefore, the first problems to consider are the uniform volume of the milk supply and whether or not there is already a suitable market for all the milk that is produced. Where a manufacturing plant is already established, an additional factory may cause both plants to lose money and result in the farmers receiving lower prices for their milk and cream. If the territory is large enough the organization of a cheese factory may result in increased production to the extent that there will be sufficient milk for both plants to operate on a paying basis.

The cost of manufacturing 100 pounds of cheese per day is approximately the same as the cost for 500 pounds. It is generally considered, therefore, that 5,000 pounds of milk per day, which represents the production of 250 to 300 cows, is the smallest quantity that can be manufactured into cheese profitably. One man can handle this quantity unless the output or a large part of it is put up in small cheeses, such as young Americas, 5-pound prints, or other small or fancy packages, in which case a helper should be employed. An experienced man for helper, however, is not necessary. The extra price received for small cheeses should more than pay the helper's salary.

#### QUALITY OF MILK

The quality of the cheese will be no better than the quality of the milk from which it is made. The milk, therefore, should be sweet and free from objectionable flavors, such as wild onion. Overripe or sour milk is difficult to handle in the cheese vat and at best results in excessive losses of fat during the process of making, which reduces the yield and injures the quality of the cheese. Milk should not contain more than 0.18 or 0.20 per cent acidity when received at the factory. If the milk is not carefully graded and if sour or off-flavored milk is accepted, the result will be an inferior quality of cheese which must be marketed at a low price.

Under certain conditions it is no doubt advisable to pasteurize milk for cheese making. An inferior quality of milk when pasteurized will make a better quality of cheese and result in a higher yield than such milk made up unpasteurized. In some sections of the country with a warm climate, when milk is collected over a large area and arrives at the factory late in the day, it is being pasteurized for cheese making apparently with success.

A cool climate and plenty of cool water makes possible the production and delivery of good milk with less effort and expense on the part of the dairyman. Mountain sections as a rule have good grazing, cool nights, plenty of cool running spring water on the farms, and are, therefore, especially adapted to cheese making.

#### PRICES PAID FOR MILK MADE INTO CHEESE

The price paid for milk at a cheese factory depends upon the volume and quality of milk received, the yield of cheese from 100 pounds of milk, and the market price of cheese. Most of these factors are influenced, to some extent at least, by the management.

The manager of a cheese factory, along with many other important duties, has the responsibility of employing an operator or a

cheese maker. In selecting a cheese maker, great care should be taken to obtain a competent and reliable man, because in the case of an organization handling 5,000 pounds of milk daily the amount of money lost in one day through careless handling of the milk or curd may be sufficient to pay the salary of a good cheese maker for a week or to raise the price of butterfat 1 cent per pound on all milk received for the entire month. Cheese that does not have the proper finish or that has become moldy, conditions which often occur when an inefficient cheese maker is employed, will in most cases sell from 1 to 2 cents below the market price, causing an organization handling 5,000 pounds of milk daily to lose from \$150 to \$300 per month.

The cheese market fluctuates from month to month and from year to year, as shown in Tables 1, 2, and 3, thereby affecting the price of milk.

Table 1 shows the average monthly prices of cheese for the years 1922-1927 on the sales on single Daisies. Tables 2 and 3 show monthly and yearly average prices of cheese (1922-1927) on the Wisconsin primary markets and the estimated returns from milk based on these prices.

TABLE 1.—Average monthly prices of cheese on Wisconsin primary cheese markets f. o. b. shipping points, majority sales on single Daisies, 1922-1927

Month	1922	1923	1924	1925	1926	1927	6-year average
	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>
January.....	20.59	26.87	23.10	24.25	24.24	25.55	24.10
February.....	21.49	24.99	21.89	23.05	22.94	24.13	23.08
March.....	19.63	22.84	20.70	22.76	20.88	22.75	21.59
April.....	16.09	20.82	17.58	22.53	18.93	22.18	19.69
May.....	16.93	22.63	18.08	21.90	19.09	22.39	20.17
June.....	18.39	23.47	18.88	22.47	19.88	22.50	20.93
July.....	19.31	21.78	18.31	21.82	19.75	22.46	20.57
August.....	19.02	23.42	19.23	23.01	20.93	24.04	21.61
September.....	21.00	25.18	20.44	22.98	22.21	25.31	22.85
October.....	24.76	25.15	19.06	23.84	23.63	27.86	24.05
November.....	25.13	24.45	19.45	23.32	23.92	25.78	23.67
December.....	27.19	23.04	21.96	23.87	24.88	27.50	24.74
Average.....	20.79	23.72	19.89	22.98	21.77	24.37	22.25

TABLE 2.—Monthly average prices of cheese for six years, on Wisconsin primary cheese markets and estimated returns from milk based on these prices, 1922-1927

Month	Average price per pound for cheese	Net return to farmers for milk containing 4 per cent butterfat		Month	Average price per pound for cheese	Net return to farmers for milk containing 4 per cent butterfat	
		Per 100 pounds milk	Per pound butterfat			Per 100 pounds milk	Per pound butterfat
	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>		<i>Cents</i>	<i>Cents</i>	<i>Cents</i>
January.....	24.10	223	55.7	August.....	21.61	196	49.0
February.....	23.08	212	53.0	September.....	22.85	209	52.2
March.....	21.59	196	49.0	October.....	24.05	222	55.5
April.....	19.69	176	44.0	November.....	23.64	218	54.5
May.....	20.17	181	45.2	December.....	24.74	229	57.2
June.....	20.93	189	47.2				
July.....	20.57	185	46.2	Average.....	22.25	203	50.7

TABLE 3.—Yearly and 6-year average price of cheese on Wisconsin primary cheese markets and estimated returns from milk based on these prices, 1922-1927

Year	Average price per pound for cheese	Net return to farmers for milk containing 4 per cent butterfat		Year	Average price per pound for cheese	Net return to farmers for milk containing 4 per cent butterfat	
		Per 100 pounds milk	Per pound butterfat			Per 100 pounds milk	Per pound butterfat
	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>		<i>Cents</i>	<i>Cents</i>	<i>Cents</i>
1922.....	20.79	187	46.9	1926.....	21.57	198	49.5
1923.....	23.72	219	54.7	1927.....	24.37	225	56.2
1924.....	19.89	178	44.5				
1925.....	22.98	211	52.7	Average.....	22.25	203	50.7

Cheese yields from 100 pounds of milk containing different percentages of butterfat may be calculated as follows: 3 per cent butterfat, 8.3 pounds cheese; 4 per cent butterfat, 10.6 pounds cheese; 5 per cent butterfat, 12.9 pounds cheese; 5.5 per cent butterfat, 14 pounds cheese.

The cost of manufacture per pound of cheese varies from 3 to 5 cents, depending upon the volume of milk. For every 100 pounds of milk there are approximately 85 pounds of whey, which, as a feed for hogs, is worth about one-half as much as skim milk, or 100 pounds is worth one-fourth as much as a bushel of corn. To get the price to be paid for milk, deduct from the selling price of the cheese the cost per pound to manufacturer and multiply by the amount of cheese made per 100 pounds of milk. To this add the amount received for whey cream. When a dairyman has his whey returned, he should add to the price received for his milk the value of his whey. For example, if cheese sells for 23 cents per pound and the cost of manufacture is 4 cents, the difference is 19 cents. If the milk from which this cheese was made tests 4 per cent, the quantity of cheese made from 100 pounds of milk is 10.6 pounds. Multiplying 19 cents by 10.6 gives \$2.01, the net amount received for the cheese. If the 85 pounds of whey contains 0.3 per cent butterfat and if butterfat sells for 40 cents per pound, the amount received for the whey cream is 10 cents, which, added to \$2.01, gives \$2.11 as the price that can be paid for 100 pounds milk.

#### LOCATION OF THE CHEESE FACTORY

When deciding on the location of a cheese factory the following points should be taken into consideration: Milk supply, water supply, drainage, and condition of roads over which cheese and supplies must be hauled.

Cheese factories should be located in sections densely populated with cows because volume of milk is necessary to reduce the cost of manufacture per pound. In such sections sufficient milk can be obtained within a short distance of the factory. This makes it possible for all the milk to be delivered early in the day, thus insuring a better quality of milk and allowing more time for the manufacture of cheese.

An abundant supply of clean pure water is essential. It is important, therefore, that the supply be within easy reach of the factory.

Good drainage is necessary because of much waste or refuse. Improper drainage causes disagreeable odors and unsanitary conditions in and about the factory. Because the latter conditions so often exist, it is sometimes believed that a cheese factory is a nuisance in any town or community; but when the factory is well constructed with concrete floors, proper drainage, and is kept in a sanitary condition, there will be no trouble from these sources.

It is best to locate the factory on a good road, as the cost of hauling cheese and supplies will be noticeably affected. Another advantage which a good road offers is that a considerable quantity of cheese can be sold at the factory to the passing public.

It is sometimes advisable to establish a cheese factory in connection with a milk plant to utilize the surplus milk during certain seasons of the year, or in connection with a creamery where a sufficient number of the producers demand a whole-milk market, provided, of course, the volume is sufficient to manufacture both butter and cheese at a reasonable cost.

In the past it was the custom to establish cheese factories from 2 to 4 miles apart. This was no doubt due partially at least to the bad condition of roads over which milk had to be hauled in wagons. A short hauling distance was necessary in order that the farmer might deliver his milk to the factory in a suitable condition for cheese making. Under such conditions the small factory may serve more satisfactorily; but where roads have been improved and the automobile truck is extensively used, fewer and larger factories are being built. At present factories operate very successfully in warm climates and collect the milk in trucks within a radius of 20 to 25 miles of the factory. The majority of these factories, however, are pasteurizing the milk at 160° F. over flash pasteurizers.

### PLAN AND COST OF BUILDING

The cost of a building suitable for cheese making depends entirely upon the type and size of factory, source of water supply, and drainage system. The illustration on the cover page of this publication shows a factory with a capacity of 10,000 pounds of milk daily. This factory is located on a good highway 6 miles from town in the southern mountains, which is one of the sections of the country where mechanical refrigeration is not necessary. The west side of the factory is on a bank 10 feet high and is well shaded. This is a frame building with concrete foundation and floors. A spring 500 feet from the factory supplies the water, and the drainage is carried about 1,200 feet through 4-inch tiling to a creek. The curing room is boarded, papered, and weatherboarded on the outside, and boarded, papered, and ceiled on the inside. The rest of the building is boarded, papered, and weatherboarded on the outside and ceiled on the inside. Practically all the material for this factory except the cement was furnished locally, the building operations were supervised by a stockholder in the organization, and the cost of the building was approximately \$1,800. The cheese made at this plant is all cured at the factory.



FIG. 1.—A modern cheese factory with a daily capacity of 20,000 pounds of milk



FIG. 2.—The manufacturing room of the cheese factory shown in Figure 1

Figure 1 shows a factory with a capacity of 20,000 pounds of milk daily. It is located in a warm climate 10 miles from town. This is also a frame building with insulated walls and concrete foundation and floors. A deep well supplies the water, and the drainage is properly disposed of through 2,000 feet of tiling. This factory cost approximately \$5,000. The cheese is shipped to cold storage when about 5 days old.

Figure 2 shows the manufacturing room in the factory shown in Figure 1. Two 10,000-pound cheese vats, mechanical agitators, presses, and milk pasteurizer are shown. Figure 3 is the weigh room in the factory shown in Figure 1. Figure 4 is the curing room in the



FIG. 3.—The weigh room of the cheese factory shown in Figure 1.

factory shown in Figure 1. Cheeses on shelves are less than 5 days old. Those in boxes have just been paraffined and are ready to go to cold storage.

### REFRIGERATION

When cheese is made in mountain districts or where the climate is comparatively cool, curing rooms may be so constructed, banked, or insulated that cheese can be held until marketed without mechanical refrigeration. If practical, however, it is best to cure the cheese at a lower temperature than would be obtained without mechanical refrigeration, especially if it is to be held more than a month or six weeks.

When cheese is made in a warm climate mechanical refrigeration should be provided, unless the cheese is sold from the press or shipped to a central curing plant where temperatures can be controlled. High

temperatures in the curing room not only cause heavy losses in shrinkage but also injure the quality and appearance of the cheese.

### NECESSARY EQUIPMENT AND COST

The cost of equipment depends upon the size of the factory and whether or not a pasteurizer and mechanical refrigeration are included.

For a factory handling 5,000 pounds of milk daily, the equipment, not including a pasteurizer or mechanical refrigeration, costs ap-



FIG. 4.—The curing room of the cheese factory shown in Figure 1

proximately \$2,500. A pasteurizer costs about \$1,000 and mechanical refrigeration approximately \$2,000. The following is a list of equipment for a factory handling 5,000 pounds of milk daily:

- |                                                |                                                 |
|------------------------------------------------|-------------------------------------------------|
| 1 12-horsepower boiler.                        | 1 whey strainer.                                |
| 1 2-horsepower steam engine or electric motor. | 2 thermometers.                                 |
| 1 600-gallon steam-heating cheese vat.         | 1 24-bottle Babcock tester complete.            |
| 1 continuous-pressure gang press.              | 36 sample jars.                                 |
| 30 Daisy hoops.                                | 1 cheese knife.                                 |
| 1 whey separator.                              | 1 cheese trier.                                 |
| 1 power curd mill.                             | 1 acid test.                                    |
| 1 scale for weighing salt.                     | 1 rennet test.                                  |
| 1 700-pound scale for weighing milk.           | 1 moisture test complete.                       |
| 1 100-pound counter scale.                     | 1 paraffining tank.                             |
| 1 weigh can.                                   | 1 wash sink, equipped with noiseless heater.    |
| 1 milk conductor with head.                    | Steam pipe and fittings.                        |
| 1 set of curd knives.                          | 1 2-inch sanitary steam jet for elevating whey. |
| 2 14-quart pails.                              | 1 20-gallon starter can.                        |
| 1 curd scoop.                                  | Whey tanks and sanitary fittings.               |
| 1 dipper, gallon size.                         | 1 can rinser and drier.                         |
| 1 strainer dipper, gallon size.                | 1 pay and record book.                          |
| 1 curd fork.                                   |                                                 |

The following is a list of necessary supplies for two months for the above size factory:

Fuel.	4,000 scale boards.
7 gallons rennet.	1 barrel of washing powder.
4 gallons cheese color.	5 gallons sulphuric acid.
3 barrels cheese salt.	12 milk-receiving sheets.
500 pounds paraffin.	1 bottle lactic culture.
2,000 Daisy cheese bandages.	2 vat brushes.
4,000 cloth circles, 12½ inches in diameter.	1 floor broom.
200 press cloths, 14 inches in diameter.	2 sample-bottle brushes.
2,000 cheese boxes.	2 vat-gate brushes.

For a factory handling 20,000 pounds of milk daily the equipment, not including a pasteurizer and mechanical refrigeration, costs approximately \$6,000. A pasteurizer costs approximately \$1,500 and mechanical refrigeration about \$3,500. The following is a list of equipment for a factory handling 20,000 pounds of milk daily:

1 20-horsepower boiler.	2 whey strainers.
1 2-horsepower steam engine or electric motor.	4 thermometers.
2 10,000-pound steam-heating cheese vats.	1 36-bottle Babcock tester complete.
2 continuous-pressure gauge presses.	72 sample jars.
85 Daisy hoops.	1 cheese knife.
96 longhorn hoops.	1 cheese trier.
1 whey separator.	1 acid test.
1 power curd mill.	1 rennet test.
1 1,000-pound scale for weighing milk.	1 moisture test complete.
1 100-pound counter scale.	1 paraffining tank.
1 weigh can.	1 wash sink equipped with noiseless heater.
1 milk conductor with head.	Steam pipe and fittings.
1 set curd knives.	1 3-inch sanitary jet for elevating whey.
4 14-quart pails.	1 starter can, 100-gallon size, whey tanks, and sanitary fittings.
2 curd scoops.	1 can rinser and drier.
2 dippers, gallon size.	1 pay and record book.
2 strainer dippers, gallon size.	
2 curd forks.	

The following is a list of supplies for two months for the above-sized factory:

Fuel.	8,000 scale boards.
28 gallons rennet.	2 barrels washing powder.
16 gallons cheese salt.	10 gallons sulphuric acid.
1,500 pounds paraffin.	12 milk receiving sheets.
6,000 Daisy cheese bandages.	1 bottle lactic culture.
6,000 longhorn cheese bandages.	6 vat brushes.
12,000 cloth circles.	2 floor brooms.
400 press cloths.	4 sample-bottle brushes.
4,000 Daisy cheese boxes.	6 vat-gate brushes.
2,000 longhorn cheese boxes.	

Suggestions for starting and operating a cheese factory, together with plans and specifications for the building, may be obtained from your State agricultural college or from the Bureau of Dairy Industry, United States Department of Agriculture, Washington, D. C.

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December 7, 1928

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